Sabrina Forrest

START 3

Superfund Technical Assessment and Response Team 3 - Region 8

United States
Environmental Protection Agency
Contract No. EP-W-05-050

DATA GAP ANALYSIS REPORT for TARGETED NATIONAL PRIORITY LISTING VIABILITY Revision 2

UPPER ANIMAS MINING DISTRICT
San Juan County, Colorado
CERCLIS ID CO0001411347

TDD No. 0812-01

October 13, 2009

URS
OPERATING SERVICES, INC.

In association with:
Garry Struthers Associates, Inc.
LT Environmental, Inc.
TechLaw, Inc.
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TN & Associates. Inc.

URS OPERATING SERVICES

1099 18TH STREET
SUITE 710
DENVER, COLORADO 80202-1908
TEL: (303) 291-8200
FAX: (303) 291-8296

October 13 2009

Ms. Sabrina Forrest
Site Assessment Manager
U.S. Environmental Protection Agency, Region 8
Mail Code: 8EPR-B
1595 Wynkoop Street
Denver, Colorado 80202-1129

SUBJECT: START 3, EPA Region 8, Contract No. EP-W-05-050, TDD No. 0812-01
Revision 2
Data Gap Analysis Report for Targeted National Priority Listing Viability, Upper Animas Mining District, San Juan County, Colorado

Dear Sabrina:

Attached is one copy of the Revision 2 of the Data Gap Analysis Report for Targeted National Priority Listing Viability of the Upper Animas Mining District in San Juan County, Colorado. This report covers the evaluation of the Cement Creek drainage.

This document has been revised to your comments and is submitted for your approval.

If you have any questions, please call me at 303-291-8270.

Sincerely,

URS OPERATING SERVICES, INC.

Barry Hayhurst
Project Manager

cc: Charles W. Baker/UOS (w/o attachment)
File/UOS

DATA GAP ANALYSIS REPORT for TARGETED NATIONAL PRIORITY LISTING VIABILITY Revision 2

UPPER ANIMAS MINING DISTRICT San Juan County, Colorado

CERCLIS No. CO0001411347

EPA Contract No. EP-W-05-050
TDD No. 0812-01

Prepared By:
Barry Hayhurst
Environmental Scientist

URS Operating Services, Inc.
1099 18th Street, Suite 710
Denver, CO 80202-1908

Approved: ______________________ Date: 01/04/10
Sabrina Forrest, Site Assessment Manager, EPA, Region 8

Approved: ______________________ Date: 10/14/09
Charles W. Baker, START 3 Program Manager, UOS

Approved: ______________________ Date: October 9, 2009
Barry Hayhurst, Project Manager, UOS

DISTRIBUTION LIST

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Sabrina Forrest (2 copies)	Site Assessment Manager, EPA Region 8

COLORADO DEPARTMENT OF PUBLIC HEALTH AND THE ENVIRONMENT

Barbara Nabors (2 copies)	Superfund and Site Assessment Unit Leader

URS OPERATING SERVICES, INC.

Barry Hayhurst	Project Manager, START 3, EPA Region 8
File (2 copies)	START 3, EPA Region 8

DATA GAP ANALYSIS – Revision 2
UPPER ANIMAS MINING DISTRICT - CEMENT CREEK
San Juan County, Colorado

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1.0 INTRODUCTION

This Data Gap Analysis of the Cement Creek drainage in the Upper Animas Mining District in San Juan County, Colorado, (CERCLIS ID CO0001411357) relates to documented contamination found in the Animas River below Silverton, Colorado. This report has been prepared to satisfy the requirements of Technical Direction Document (TDD) No. 0812-01 issued to URS Operating Services, Inc. (UOS) by the Region 8 office of the U.S. Environmental Protection Agency (EPA). No formal site reconnaissance was conducted by START 3 personnel. This report is based on a review of files at the EPA Records Center and the Colorado Department of Public Health and the Environment (CDPHE) and interviews with personnel of city, county, state, and federal agencies involved with the previous investigations, and members of the Animas River Stakeholders Group (ARSG).

2.0 OBJECTIVES

The objectives of this Data Gap Analysis are to determine if data gaps exist in the body of the previous work conducted in the Upper Animas Mining District, specifically in the Cement Creek Watershed, to determine if data gaps can be identified, and to evaluate whether additional investigation, including additional sampling, is appropriate. Specifically, objectives include the following:

- Evaluate information provided regarding potential sources, pathways, and targets to identify data gaps.
- Evaluate data and the quality of the data for use in evaluating the site using the Hazard Ranking System (HRS) criteria (Office of the Federal Register (OFR) 1990).
- Identify data gaps and present an accurate evaluation of the site based on HRS criteria.

3.0 SITE DESCRIPTION

3.1 SITE LOCATION

Cement Creek originates high in the rugged San Juan Mountains of southwestern Colorado near the San Juan County and Ouray County line on the south slopes of Red Mountain Number 3 and the north slopes of Storm Peak. Cement Creek begins at an elevation of 13,000 feet above mean sea level (MSL) and flows seven miles southward to an elevation of 9,305 feet above MSL at its confluence with the Animas River at Silverton, Colorado (Figures 1 and 2) (Colorado Department of Public Health and Environment (CDPHE) 1998). The name Cement Creek probably refers to the iron rich precipitates (ferricrete) that coat and cement the stream bed materials (Photos 1 and 2) (USGS 2007f).

3.2 SITE CHARACTERISTICS

3.2.1 Geologic Setting

The Cement Creek basin is located in the volcanic terrain of the San Juan Mountains. The area was a late Oligocene volcanic center that witnessed the eruption of many cubic miles of lava and volcanic tuffs that covered the area to a depth of more than a mile (USGS 1969) The formation of the 10-mile diameter Silverton caldera produced faults that are generally concentric circular features. The caldera collapse was followed by multiple episodes of hydrothermal activity that produced widespread alteration and mineralization of the rocks (USGS 2007a). Cement Creek flows through the middle of the old Silverton caldera (U.S. Environmental Protection Agency (EPA) 1999).

The predominate rock type found in the Cement Creek Basin are the Oligocene Age Silverton Volcanics. The Silverton Volcanics are lava flows of intermediate to silicic composition and related volcaniclastic sediments that accumulated to a thickness of approximately 1,000 feet around older volcanoes prior to the subsidence of the Silverton Caldera (USGS 2002).

The regional propylitization of the rocks in the area prior to the collapse of the calderas created an altered regional rock type that contains significant amounts of calcite ($CaCO_3$), epidote ($Ca_2Fe(Al_2O)(OH)(Si_2O_7)(SiO_4)$), and chlorite ($(MgFeAl)_6(SiAl)_4O_{10}(OH)_8$) all of which contribute to the intrinsic acid-neutralizing capacity of the major regional rock type. Three major areas of post caldera collapse mineralization and alteration have been identified in the Cement Creek drainage (Figure 2). The Ohio Peak-Anvil Mountain (OPAM) area on the west side of the lower Cement Creek drainage and the Red Mountains area on the northwest side of the upper Cement Creek drainage are both sites of 23-million-year-old acid-sulfate mineralization. The Eureka Graben area on the upper northeast side of the Cement Creek drainage is the site of 18- to 10-million-year-old emplacement of northeast-trending polymetallic veins of silver, lead, zinc, copper, and often gold that formed as fracture or fissure filling material (USGS 2007d).

The Red Mountain and OPAM acid-sulfate hydrothermal systems cover 22 square kilometers and 21 square kilometers respectively along the margin of the collapsed Silverton Caldera on the west and northwest side of the Cement Creek Drainage (Figure 2). Most of the mineralization and mining activity in these two areas have occurred in the Red Mountain area with mines and adits related to the Red Mountain acid-sulfate system found in Prospect, Dry, Georgia and Corkscrew Gulches, all tributaries of Cement Creek. The ores from these mines commonly contain enargite (Cu_3AsS^4), galena (PbS), chalcocite (Cu_2S), tetrahedrite ($(Cu,Fe)_{12}(Sb,As)_4S_{13}$), stromeryite (AgCuS), bornite (Cu_5FeS_4), chalcopyrite ($CuFeS_2$), and pyrite (FeS_2) along with elemental arsenic (As), copper (Cu), lead (Pb), and iron (Fe) (USGS 2007d).

Mineralization in the veins of the Eureka Graben that is drained by upper Cement Creek include massive pyrite and milky quartz (FeS_2—$Si0_2$), chalcopyrite ($CuFeS_2$), galena (PbS), sphalerite (ZnS), fluorite (CaF), and elemental gold (Au), and silver (Ag) (USGS 2007d).

The San Juan Mountains were nearly covered by alpine glaciers during the latest Pleistocene Pinedale glaciation. The thickness of glacial ice is estimated to have ranged from approximately 1,400 feet thick at Gladstone to 1,700 feet thick at Silverton. The Pinedale glaciation ended approximately 12,000 years ago and except for the glacial till deposits all surface sediments along Cement Creek were likely deposited after that date (USGS 2007f). Approximately 6,000 years ago Cement Creek cut into the creek bed sediments by as much as 16 feet causing a drop in the valley bottom shallow water table aquifer. Beginning about A.D. 400 Cement Creek aggraded the stream bed by as much as 10 feet and then between A.D. 1330 and A.D. 1700 Cement Creek cut back to the previous level established approximately 6,000 years ago. These changes in the shallow water table elevations in the valley caused mineralization and cementation of the sediments in the stream course (USGS 2007f).

Recent human activities have had relatively little influence on the overall shape and physical processes of Cement Creek (USGS 2007f).

Groundwater in the Cement Creek area is found in cracks and fissures in the near surface of the igneous rocks that comprise the majority of the area.

3.2.2 Hydrologic Setting

The drainage area of Cement Creek is 20.1 square miles (USGS 2007b). Cement Creek flows through the middle of the old caldera with the period of high flow being May, June, and July, in response to snowmelt in the San Juan Mountains and the period of low flow occurring in later winter and late summer (EPA 1999). The average flow measured by the USGS on Cement Creek at Silverton before the confluence with the Animas River at station number 09358550 between 1992 and 2008 (excluding 1994) was 38.3 cubic feet per second (cfs). The highest average flow on Cement Creek was 56.3 cfs during 1995 and the lowest was 17 cfs during the drought of 2002 (USGS 2009). The drainage area of the Animas River is 146 square miles (USGS 2007b). The average flow measured by the USGS on the Animas River below Silverton at station number 09359020 between 1992 and 2008 was 281 cfs (USGS 2009).

3.2.3 Meteorological Setting

The Upper Animas River Basin and Cement Creek are located in an alpine climate zone. The annual precipitation in the area is about 40 inches. Winter snowfall is heavy and severe rain storms occur in the summer (USGS 1969). The average total precipitation for Silverton, Colorado as totaled from the Western Regional Climate Center database is 24.50. The 2-year, 24-hour rainfall event for this area is 2 inches (National Oceanic and Atmospheric Administration (NOAA) 1973).

4.0 SITE HISTORY AND PREVIOUS WORK

4.1 MINING ACTIVITIES

The rugged and relatively inaccessible western San Juan Mountains were first prospected by the Baker party, which explored the area around Silverton in 1860. After a treaty with the Ute Indians was revised, mining began in 1874 and George Green brought the first smelter equipment into the area at Baker's Park that year (Silverton Magazine 2009). The extension of the railroad from Silverton up Cement Creek to Gladstone in 1899 encouraged the mining of low grade ores and the establishment of a lead-zinc flotation plant in 1917 allowed for the treatment of the low grade complex ores found in the area (USGS 1969). The last producing mine in the area was the Sunnyside Mine, which ceased production in 1991 (USGS 2007c). The closing of the Sunnyside mine occurred after Lake Emma drained into the mine and out the American Tunnel into Cement Creek in 1978. The flood water from the Lake Emma "blow-out" were reported to have flowed down Cement Creek in a 10-foot tall wall of water that would have transported a large quantity of tailing and other mine waste down Cement Creek to the Animas River (The Silverton Railroads 2009).

Over a 100-year period between 1890 and 1991, mining activities in the Upper Animas River Basin, including Cement Creek, produced the waste rock and mill tailings sources from which contamination spread throughout the surface water pathway. Over 18 million tons of ore were mined from the Upper Animas River Basin area with more than 95 percent of this being dumped directly into the Animas River and its tributaries in the form of mill waste. Older waste rock piles and stope fillings were reworked and sent to mills as technology allowed lower grade ores to be economically processed. A great deal of abandoned waste was also milled during World War II when many older mining and milling structures were cannibalized for scrap metal. The history of mining and milling in the Cement Creek area can be divided into four eras, each of which produced different types and volumes of mine wastes.

- Phase 1 – The Smelting Era (1871 -1889). Mines were usually small, mining was done by hand, milling was rarely done, and small amounts of often highly mineralized rock were left in surface dumps. Zinc minerals were preferentially removed from the ore and left in mine dumps because zinc created problems during the smelting process. Total production of the entire Upper Animas River area during this era is estimated to be 93,527 short tons. Very little mine or mill tailings were directly discharged into the area streams (USGS 2007c).

- Phase 2 – The Gravity Milling Era (1890-1913). Federal Government supports coupled with the introduction of higher capacity mining and milling techniques encouraged the mining of lower grade ores. Milling became the predominate ore processing method as ore values dropped and tonnage increased. Large volumes of mine and milling wastes were discharged directly into streams. Gravity mills recovered as much as eighty percent of the metals; however, zinc, iron pyrite, and some copper compounds were not recoverable and when discharged into the streams were easily spread downstream throughout the environment. Between 1890 and 1913 the total production of the entire Upper Animas River area was estimated at 4.3 million short tons, of which approximately 95 percent was discharged directly into the area streams (USGS 2007c).

- Phase 3 – The Early Flotation Era (1914-1935). The increased demand for metals caused by World War I further accelerated the trend to larger scale mining and milling in the area. Ball mill grinding and froth flotation for concentrating ores were introduced and again most mill tailings were dumped directly into area streams. During this era total production of the entire Upper Animas River area was estimated at 4.2 million short tons of which only 36,232 short tons were shipped out of the area to be smelted (USGS 2007c).

- Phase 4 – The Modern Flotation Era (1936-1991). Mining almost came to a halt during the Great Depression, but mining activity resumed during World War II when many mines and mills were reopened with substantial support from the Federal Government. In addition to the newly mined material, waste rock from abandoned mines in both the waste dumps and the old underground stope fills was reclaimed and processed. Mining and milling processes improved in detail, but still used familiar technology. The major change was the impoundment of mill tailings that began as a result of a 1935 Colorado Supreme Court ruling that required operations to contain mill tailings. Some early attempts to contain mill tailings were not totally successful and resulted in catastrophic releases of mill tailings to the area streams. Mining and milling in the Upper Animas River area had substantially decreased by 1953 and all mining and milling activity ceased in 1991. During this era total production of the entire Upper Animas River area was estimated at 9.5 million short tons. All mill tailings were impounded in settling ponds except for an estimated 200,000 short tons of mill tailings that were released into the Animas River area streams. Ore shipments to smelters totaled only 8,148 tons out of the 9.5 million short tons of production during this final era (USGS 2007c).

Reclamation activities have been ongoing in the Cement Creek basin since 1991 when tailings were removed from the Lead Carbonate Mill site. Remediation work has also be conducted in Gladstone at the American Tunnel waste dump, Mayflower Mill, Gold King Mine, Galena Queen, Hercules Mine, Henrietta mines, and most recently at the Joe and John Mine and the Lark Mine in 2006 and 2007 (Animas River Stakeholders Group (ARSG). 2007). No new reclamation activities have been initiated in 2008 or 2009 (Animas River Stakeholders Group (ARSG) 2009).

4.2 SUMMARY OF PREVIOUS ENVIRONMENTAL ASSESSMENT WORK

- March 1995 — *Reconnaissance Feasibility Investigation Report of the Upper Animas River Basin.* Colorado Division of Minerals and Geology. J. Herron, B. Stover, P. Krabacher, and D. Bucknam.

- October 1995 — *Animas Discovery Report – Upper Animas River Basin.* CDPHE Hazardous Materials and Waste Management Division. Camille Farrell.

- February 1997 — *Water Quality and Sources of Metal Loading to the Upper Animas* River Basin. CDPHE-Water Quality Control Division. J. Robert Owen.

- July 1997 — *Sampling and Analysis Plan for a Site Inspection of the Upper Animas Watershed, Silverton Mining District, San Juan County, Colorado.* CDPHE Hazardous Materials and Waste Management Division. Camille Farrell.

- April 1998 — Analytical Results Report, Cement Creek Watershed, San Juan county, Colorado. Colorado Department of Public Health and Environment – Hazardous Materials and Waste Management Division. Camille Farrell. Five ground water, 6 surface water, 53 sediment, and 15 source samples collected in 1996. Data validation reports are not available. These data are not usable for a HRS evaluation of the site because sample locations are not documented and data validation cannot be documented.

- September 1998 — *Cement Creek Reclamation Feasibility Report, Upper Animas River Basin.* Colorado Division of Minerals and Geology. Jim Herron, Bruce Stover, and Paul Krabacher. Forty waste rock locations and four soil locations in the Cement Creek drainage were sampled by collecting a liquid extract of the rock or soil material from 10 to 20 aliquots at each location. These data are not usable for a HRS evaluation of the site because the analytical results are for extracts from composite samples.

- March 1999 — *Site Inspection Analytical Results Report for the Upper Animas Watershed, San Juan County, Colorado.* CDPHE Hazardous Materials and Waste Management

Division. Camille Farrell. Samples of mine waste rock, seeps, surface water, and sediment collected in 1997. Exact locations of samples were not documented. Photographs of sample locations are available. Data validation reports are not available. These data are not usable for a HRS evaluation of the site because sample locations are not documented and data validation cannot be documented.

5.0 PRELIMINARY PATHWAY ANALYSIS

5.1 SOURCE CHARACTERIZATION

Twenty-eight unremediated individual sources of mine wastes have been identified in the Cement Creek drainage totaling approximately 145,690 cubic yards. Five other sources have been remediated of approximately 48,880 cubic yards. These locations are shown on Figure 2, Table 1 lists all of the 33 sources and was compiled from data published by the U.S. Geological Survey (USGS), Colorado Division of Minerals and Geology, and the CDPHE Hazardous Materials and Waste Management Division. Thirteen of these identified mine waste rock sources were sampled by the CDPHE in the autumn of 1996 and analyzed by a Contract Laboratory Program (CLP) laboratory. The results are presented in Table 4. Data validation reports for the data were not located during file research for this report so the data quality of these results cannot be documented. Exact locations for the samples were not recorded and maps for the 1996 sampling reports have been separated from the reports and these maps have not been located. The arsenic concentrations on the mine waste rock samples ranged from 3 milligrams per kilogram (mg/kg) to 324 mg/kg and all of the arsenic values were qualified, but no explanation was given. Lead values in the mine waste rock samples from the Cement Creek mine sites ranged from 168 mg/kg to 74,000 mg/kg. Copper concentrations ranged from 7.1 mg/kg to 3,470 mg/kg, cadmium concentrations ranged from non-detect to 176 mg/kg, silver concentrations from 2.1 mg/kg to 115 mg/kg, and zinc concentrations ranged from 28.5 mg/kg to 22,300 mg/kg. The highest concentrations of cadmium, copper and silver were detected in the mine waste rock from Upper Cement Creek and the highest concentrations of arsenic, lead, and zinc were detected in the mine waste rock from Prospect Gulch (Table 4) (CDPHE 1998).

The USGS compiled geochemical data on mine dump composition from published and unpublished data that are presented in Table 2 (USGS 2007d). These results show that the mine waste dumps in the Red Mountain Area, represented in the Cement Creek drainage by Prospect Gulch, have higher concentrations of arsenic, copper, iron, and strontium. The two highest concentrations of arsenic detected in the 1996 CDPHE sampling were both in mine waste from Prospect Gulch at 324 mg/kg and 154 mg/kg (Table 4). Lead, silver, and zinc have their highest detections in the Ohio Peak-Anvil Mountain Area, on the west side of lower Cement Creek (Table 2). No mines dumps representing this area were sampled by CDPHE in 1996. The mine waste rock in the Eureka Graben area tends to have higher concentrations of barium, cadmium, manganese, and molybdenum (Table 2) (USGS 2007d).

Data gaps identified in the source characterization include:

- Documentation with validated data of source contaminant characteristics; and
- Documentation of relationships of sources to stream sediment contamination.

TABLE 1
33 Historic Sources of Mine Waste in the Cement Creek Drainage

Mine Name[1]	Location[1]	Waste Volume[1] (yd^3)	Distance to stream[1] (ft)	Previous Sample Number[2]	Description of Mine Waste[3]
Adams Mine	Upper Cement Creek	800	320	-	unmineralized country rock
Anglo Saxon Mine	Lower Cement Creek	2,200	50	CC-SO-25	fine to medium grained sulfide mine waste-pyrite in altered country rock, above a 1-acre wetland
Big Colorado Mine	South Fork Cement Creek	27,000	45	-	dominantly unmineralized country rock, small amount of sulfide waste rock
Black Hawk Mine	Middle Fork Cement Creek	12,000	67	-	lower part unmineralized country rock, upper part coarse to fine grained sulfide mine waste
Brenneman Mine	Upper Cement Creek	1,800	> 500	-	na
Columbia Mine	Upper Cement Creek	6,500	> 500	-	seven separate dumps – bright yellow and orange fine grained to coarse sulfide mine waste - pyrite
Corkscrew Pass Mine	Upper Cement Creek	1,300	Na	-	pyrite, sphalerite, enargite, arsenopyrite, and galena, near 1.5-acre alpine wetland
Elk Tunnel	Fairview Gulch	1,100	50	-	na
Galena Queen Mine	Prospect Gulch	(7,200)	in stream	PG-SO-1	grey waste rock, galena and sphalerite (1998 & 2002 engineered controls-waste consolidation & hydrologic controls)
Galty Boy Mine	Dry Gulch	1,000	566	-	pyrite and hubnerite
Gold Hub Mine (Yukon Tunnel)	Lower Cement Creek-Illinois Gulch	18,000	in stream	CC-SO-15	altered and unmineralized country rock
Grand Mogul	Upper Cement Creek	9,000	45	-	fine to very coarse bouldery sulfide mine waste - pyrite, chalcopyrite, and sphalerite
Henrietta Mine – No. 3	Prospect Gulch	< 2,000	500	-	highly pyritic mine waste
Henrietta Mine – No. 7	Prospect Gulch	(30,000)	in stream	PG-SO-4	highly pyritic mine waste (2004 engineered controls-waste consolidation & clay cap)
Henrietta Mine – No. 9	Prospect Gulch	700	300	-	highly pyritic mine waste
Hercules Mine	Prospect Gulch	(4,680)	in stream	PG-SO-2	grey waste rock – pyrite, galena, enargite, and sphalerite (2001 waste removal and re-vegetation)
Joe & John's Mine	Prospect Gulch	Na	110	PG-SO-7	sphalerite and galena (2006-2007 consolidation and burial of waste)
JSP Mine	Prospect Gulch	300		-	na
Kansas City Mine No. 1	Georgia Gulch	8,500	180	-	highly pyritic mine waste
Lark Mine	Prospect Gulch	(3,500)	216	PG-SO-5	sulfide mine waste-sphalerite, galena, silver sulfides, pyrite, chalcopyrite (2006-2007 consolidation and burial of waste)
Lead Carbonate Mine	Minnehaha Creek	(3,500)	in stream	CC-S0-10	fine, clayey to coarse sandy pyritic quartz waste (1991 removal of tailings from stream bank)
Lower Ross Basin Mine	Upper Cement Creek	900	> 1,000	-	na
Mammoth Tunnel	Georgia Gulch	< 100	100	-	mostly unmineralized country rock
Mogul Mine	Upper Cement Creek	25,000	63	CC_SO-6	fine to coarse sulfide mine waste - pyrite and sphalerite – above an 5-acre alpine wetland
Mogul South Mine	Upper Cement Creek	800	86	-	fine to coarse sulfide mine waste - pyrite
Mogul North Mine	Upper Cement Creek	400	19	-	fine to coarse sulfide mine waste - pyrite
Natalie/Occidental Mine	South Fork Cement Creek	6,800	in stream	-	na
Occidental Mine	South Fork Cement Creek	1,000	in stream	-	na
Queen Anne Mine	Upper Cement Creek	5,000	86	CC-SO-2	bright yellow and orange, fine to coarse grained sulfide mine waste – pyrite, galena, sphalerite
Red & Bonita Mine	North Fork Cement Creek	6,000	200	CC-SO-9	coarse grained pyritized and altered country rock
Silver Ledge Mine	Middle Fork Cement Creek	6,800	in stream	OP-SO-2	clayey and sandy quartz with sulfide mine waste, pyrite
Upper Gold King Mine	North Fork Cement Creek	Na	Na	OP-SO-1	na
Upper Queen Anne Mine	Upper Cement Creek	900	560	-	Bright yellow and orange fine to coarse grained sulfide mine waste - pyrite

1 US Geological Survey Professional Paper 1651. 2007e. Chapter E5, Mine Inventory and Compilation of Mine-Adit Chemistry Data.
2. Colorado Department of Public Health and Environment. 1998. Analytical Results Report, Cement Creek Watershed.
3. Colorado Division of Minerals and Geology. 1998. Cement Creek Reclamation Feasibility Report, Upper Animas river Basin.
na No information available.
yd^3 Cubic yards.
ft Feet
( ) removed or contained during remediation

TABLE 2
Summary of Selected Metals in Mine Dumps from the three Major Mineralized Areas Bordering the Cement Creek Drainage

Metals	Red Mountain Area Northwest boundary Prospect Creek & Dry Gulch 15 mine dumps			Ohio Peak-Anvil Mountain Lower Cement Creek-west side 6 mine dumps			Eureka Graben Area Upper Cement Creek tributaries Above Gladstone 18 mine dumps		
	25th percentile	75th percentile	gmean	25th percentile	75th percentile	gmean	25th percentile	75th percentile	gmean
Aluminum (Al)	4.7	7.6	5.7	7.8	8.6	**8.3**	6.7	8.0	6.9
Arsenic (As)	120	9,200	**943**	73	100	87	83	210	123
Barium (Ba)	290	470	368	308	648	479	383	848	**591**
Calcium (Ca)	0.05	0.10	0.07	0.11	0.20	**0.15**	0.05	0.19	0.13
Cadmium (Cd)	2	20	6	7	21	12	2	68	**13**
Copper (Cu)	140	26,000	**1,930**	331	613	382	100	423	189
Iron (F)	3.4	10.3	**6.1**	3.3	5.2	3.3	2.5	4.6	3.4
Lead (Pb)	600	14,300	1,870	5,720	12,750	**7,550**	1,950	15,000	3,330
Manganese (Mn)	7	175	39	441	1,040	679	425	3,580	**1,500**
Molybdenum (Mo)	4	6	5	11	25	17	22	155	**50**
Nickel (Ni)	6	18	**9**	5	7	6	4	9	6
Silver (Ag)	5	59	24	22	35	**27**	10	56	18
Strontium (Sr)	355	993	**602**	295	319	320	76	168	112
Titanium (Ti)	0.01	0.45	0.06	0.47	0.58	**0.54**	0.15	0.32	0.20
Zinc (Zn)	260	5,330	935	2,760	4,880	**3,070**	518	15,400	2,110

Source: USGS 2007d
gmean geometric mean

BOLD indicates the highest geometric mean for that element from the three mineralized areas.

5.2 GROUNDWATER PATHWAY

The town of Silverton obtains its drinking water supply from Bear and Boulder Creeks. Bear Creek is located in unmineralized terrain of the Mineral Creek drainage west-southwest of Silverton between Bear and Sultan Mountains. Boulder Creek flows into the Animas River northeast of Silverton after it passes around the Mayflower Tailings Ponds via a diversion (Figure 1) (USGS 1995, Town of Silverton 2009). The town of Silverton does not utilize groundwater (Town of Silverton 2009).

A review of the groundwater well records for wells in the Cement Creek drainage maintained by the State of Colorado Division of Water Resources identified seven domestic or household use wells. A summary of the well data is presented below in Table 3 (Division of Water Resources 2009). The average number of residents per household in San Juan County is 2.06, which indicates that approximately 14 people potentially use groundwater for domestic or household purposes in the Cement Creek drainage (U.S. Census Bureau 2009).

TABLE 3
Domestic and Household Groundwater Wells in the Cement Creek Drainage

Well Number	Well Identifier	Use
1	F. Baldwin	Household
2	E. Renaux	Domestic
3	T. Keating	Domestic
4	J. Braun	Household
5	D Ledy	Domestic
6	E. Junak	Household
7	La Chapelle	Domestic

Data gaps identified for the groundwater pathway include:

- Lack of an accurate documentation of the number of domestic use groundwater wells used by residents of Cement Creek; and

- Lack of accurate documentation of potential business use wells at Silverton Mountain Ski Area.

5.3 SURFACE WATER PATHWAY

The surface water pathway is the pathway most impacted by mining and milling activities in the Cement Creek drainage. Millions of tons of mine and mill waste were directly dumped into the area streams over a 100-year period as a normal operating practice between 1890 and 1935 and to far less extent until 1991 (USGS 2007c). The fine-grained material has had ample opportunity to spread downstream and contaminate stream sediment in the Animas River.

Surface water and stream sediments for a 1996 EPA-funded Site Inspection (SI) that included the Cement Creek drainage were collected by the CDPHE and analyzed by a CLP laboratory. These analytical data are presented in Tables 4 and 5. The analytical data were reportedly validated, but the validation reports have not been located. Map coordinates of all the sample locations have not been identified therefore it is impossible to tie every sample to a specific sample location.

The town of Silverton does not have a municipal intake on Cement Creek or the Animas River, but obtains its drinking water supply from Bear and Boulder Creeks. Bear Creek is located in unmineralized terrain of the Mineral Creek drainage west-southwest of Silverton between Bear and Sultan Mountains. Boulder Creek flows into the Animas River northeast of Silverton after it passes around the Mayflower Tailings Ponds via a diversion (Figure 1) (USGS 1995, Town of Silverton 2009). There are no surface water intakes along the Animas River within the 15-mile downstream limit for drinking water, agricultural, or industrial use and the first downstream use of surface water below the confluence of Cement Creek with the Animas River at 17-downstream miles is the Tall Timber Ditch Alternative Point that is historically used for irrigation and is owned by Beggrow Enterprises of Durango, Colorado (Colorado Division of Water Resources 2009). The Animas River might be used extensively for sport recreational boating within the 15-mile downstream limit. Six river outfitters account for at least 5,000 user days on the Animas River between Silverton and Rockwood (Mild to Wild Rafting 2009).

Cement Creek itself does not harbor any aquatic life; however, the Animas River below Silverton is stocked and fished (Colorado Department of Wildlife 2009b). Rainbow, brook, and native trout are caught in the Animas River below Silverton and consumed by humans (Outdoor World 2009). Elk Park which is approximately 5 miles downstream of Silverton on the Animas River and accessible only by foot was specifically identified as a location where fisherman catch and consume fish (Outdoor World 2009).

Approximately 2,500 feet of streamside wetlands are found along Cement Creek (Figure 2) (Photo 2) (U.S. Department of the Interior, Fish and Wildlife Service (USDOI) 1998a; USDOI 1998c). Iron bogs are found along the middle stretch of Cement Creek. Approximately 3 miles of palustrine and riverine streamside wetlands are found along the 15-mile downstream segment of the Animas River below the probable point of entry (PPE) of Cement Creek with the Animas River (USDOI 1998b; USDOI 1998d).

Data gaps identified for the surface water pathway include:

- Analytical documentation linking stream sediment contamination to specific sources of mine and mill waste;
- Documentation of the contributions of the fens/iron bogs located along Cement Creek to the total contaminate loading of Cement Creek;
- An accurate characterization and documentation of wetlands along Cement Creek and the 15-mile downstream limit of the Animas River;
- Documentation of total amount of fish caught and consumed from the 15-mile downstream stretch of the Animas River.

5.4 SOIL EXPOSURE

The USGS has identified 33 separate mine waste rock dump sites in the Cement Creek drainage. There is often no specific information available as to the accessibility of each individual waste rock dump, but generally such features are not fenced and access can by gained by recreationalists, vacationers using ATVs, motorcycles, and 4-wheel drive vehicles, rock hounds, casual tourists, and local residents. Reclamation work has been conducted at seven of the sites and in six cases involved the consolidations of waste material and the construction of engineered controls to prevent dispersal of contaminants. Approximately 120,000 cubic yards of waste and tailings have been removed from the American Tunnel waste dump and the Lead Carbonate Mill site (Animas River Stakeholders Group (ARSG) 2007). San Juan County is a popular vacation destination for outdoor activities such as hiking, ATV use, dirt biking, four-wheel driving, rock collecting, and skiing that could take place on contaminated ground. The EPA in July 2009 observed a family with toddlers riding ATVs over the Mogul Mine waste pile and closely investigating the portal where the flume is located (EPA 2009). The Silverton Mountain Ski Resort is located on Storm Peak where many of the mines in the area are located (Figure 2). Wintertime skiing activities are protected from exposure by snow cover, but summertime construction, maintenance, and recreational activities could result in exposure to contaminants in mine and mill waste material.

There are several undocumented residences in the Cement Creek drainage, but there is no record of any schools or day care facilities. Workers are present at the Silverton Ski Area on Storm Peak and in maintenance roles at old milling facilities in Gladstone. Natural occurring fens/iron bogs are found along the middle stretch of Cement Creek and contribute a component to the contaminant loading of Cement Creek.

The southwestern willow flycatcher is a federally and state endangered species in San Juan County, but is not found at this elevation. The lynx, which has been observed in the area, is a federally threatened and state endangered species and the Boreal toad is a state endangered species (Colorado Division of Wildlife 2009). The Boreal toad could live in wetlands adjacent to the stream (Colorado Department of Wildlife 2009). A list of all wildlife species found in San Juan County is included in Appendix A.

Data gaps identified for the soil pathway include:

- Lack of an accurate documentation of residents and workers in the Cement Creek valley;
- Lack of documentation of recreational use of contaminated areas; and
- Lack of documentation of the efficacy of mine waste containment for many of the waste sources in the area.

5.5 AIR PATHWAY

The air pathway was not evaluated as a part of this site reassessment because of the reportedly very low population density in the Cement Creek drainage and the fact that the ground surface is snow covered for at least six months of the year.

Data gaps identified for the air pathway include:

- Lack of an accurate documentation of residents and workers in the Cement Creek drainage;
- Lack of documentation of grain size of waste material
- Lack of documentation of recreational uses; and
- Lack of documentation of vegetative cover of many of the individual mine and mill waste material source areas.

6.0 SUMMARY

Cement Creek is a mountain stream that enters the Animas River at Silverton, Colorado. The stream originates in the volcanic terrain of an alpine region where peaks reach almost 14,000 feet in elevation. Cement Creek flows across a collapsed volcanic caldera that was actively mined for metals for 120 years, between 1871 and 1991. With the advent of modern milling techniques in the period 1890 to 1936 millions of tons of mill waste were directly disposed into the area streams. After 1936 mill wastes were required by Colorado law to be controlled and not allowed to be dumped directly into streams. Some early attempts at control were not entirely successful, but large scale dumping of mill waste in streams ceased after 1936.

The ARSG, composed of local area residents, the state of Colorado, Bureau of Land Management (BLM), U.S. Forest Service (USFS), and the EPA have been engaged in a program of study of the Upper Animas River and cleanup of the worst sources of contamination for several years and this work continues.

Twenty-eight individual unremediated historic sources of mine and mill waste totaling approximately 145,690 cubic yards have been identified in the Cement Creek drainage. Five other sources in the drainage have been remediated of approximately 48,880 cubic yards. The locations of these sources range from distant to situated in the surface water of the Cement Creek drainage. Common contaminants include arsenic, copper, lead, and zinc. The sources have been previously sampled, but the sample locations, relationships to environmental samples, and data quality cannot be documented.

There is no aquatic life in Cement Creek; however, there are approximately 2,500 feet of streamside wetlands along the steam course. Approximately three miles of streamside wetlands are located along the Animas River in the 15-mile downstream segment. Sport fishing occurs in the Animas River downstream of the confluence with Cement Creek in Silverton, Colorado through the 15-mile downstream limit. Anglers catch and consume rainbow, brook, and native trout from the 15-mile stretch of the Animas River downstream of the confluence with Cement Creek. Recreational boating occurs on the Animas River from above Silverton to Durango. Six local river tour operators account for at least 5,000 user days each year.

Domestic and household wells are found in the Cement Creek drainage. The area sees summer recreational use and the Silverton Mountain Ski Area is located in part in the Upper Cement Creek basin.

Data gaps identified include sample analytical data tying specific sources to stream sediment contamination. Also included as data gaps are lack of documentation of total amount of fish consumed, contaminant levels of fish consumed, accurate documentation of wetlands, accurate documentation of recreational user and workers, and the status of containment structures for mill and mine waste.

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TARGET SHEET

EPA REGION VIII

SUPERFUND DOCUMENT MANAGEMENT SYSTEM

DOCUMENT NUMBER: 1185323

SITE NAME: UPPER ANIMAS MINING DISTRICT

DOCUMENT DATE: 10/13/2009

DOCUMENT NOT SCANNED

Due to one of the following reasons:

- ☐ PHOTOGRAPHS
- ☐ 3-DIMENSIONAL
- ☑ OVERSIZED
- ☐ AUDIO/VISUAL
- ☐ PERMANENTLY BOUND DOCUMENTS
- ☐ POOR LEGIBILITY
- ☐ OTHER
- ☐ NOT AVAILABLE
- ☐ TYPES OF DOCUMENTS NOT TO BE SCANNED (Data Packages, Data Validation, Sampling Data, CBI, Chain of Custody)

DOCUMENT DESCRIPTION:

FIGURE 1: 15-MILE DOWNSTREAM LIMIT MAP
FIGURE 2: SITE DETAILS MAP

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TABLE 4
Cement Creek Solid Source Sample Results – Total Metals – CDPHE 1996 Sampling[1]
Concentrations in milligrams per kilogram (mg/kg)

	Upper Cement Creek				Minnehaha	Mid Fork	Lower Cement Creek	
Location	CC-SO-2	CC-SO-4	CC-S0-6	CC-SO-9	CC-SO-10	CC-SO-11	CC-SO-15	CC-SO-25
Analyte	Queen Anne Mine Waste Rock Pile	Ross Basin Unnamed Mine Waste Rock Pile	Mogul Mine Waste Rock Pile	Red & Bonita Mine Waste Pile	Lead Carbonate Mine Waste Pile *	Middle Fork Unnamed Mine Waste Rock Pile	Gold Hub Mine Waste Rock Pile	Anglo Saxon Mine * Waste Rock Pile
Aluminum	1,410	1,450	850	819	820	611	1,530	1,230
Antimony	5.8 B	48.8	41.3	0.61 U	8 B	9.6 B	1.5 B	3.2 B
Arsenic	132 J	97.1 J	23.7 J	3 J	13.5 J	10 J	9.1 J	20.7 J
Barium	527	73.4	102	138	21.7 B	19.1 B	23.1 B	149
Beryllium	0.46 B	0.43 B	0.23 B	0.21 B	0.21 U	0.21 U	0.21 U	0.25 B
Cadmium	2.9	35.6	176	0.2 U	1.5	2.8	0.87 B	0.39 B
Calcium (D)	577 B	242 B	127 B	126 B	190 B	175 B	229 B	1,660
Chromium	0.3 B	0.66 B	0.42 B	0.25 B	0.21 U	0.21 U	0.38 B	1.3 B
Cobalt	0.67 B	3.5 BJ	0.21 U	0.2 U	0.75 B	0.41 B	6.4 B	1.4 B
Copper	117	3,470	1,050	7.1	119	456	336	63.7
Iron	26,800	46,900	18,400	2,370	72,210	21,600	29,900	8,930
Lead	3,100	15,700	24,400	961	4,650	36,000	633	168
Magnesium	143 B	100 B	24.9 B	34 B	36.4 B	144 B	936 B	1,470
Manganese	137 J	104 J	373 J	4.1 J	16 J	134 J	150 J	45.5 J
Mercury	2.3 J	0.85 J	0.64 J	0.32 J	0.11 UR	0.14 J	0.1 UR	0.1 UR
Nickel	0.23 B	0.58 BJ	0.21 U	0.2 U	0.71 B	0.21 U	5.1 B	0.44 B
Potassium	1,370	2,350	631 B	421 B	646 B	513 B	1,510	739 B
Selenium	5.2	4.6	5	1	2	17	4	3.4
Silver	23 B	115	102	1.7 B	17.7	38.2	5.2	1.6 B
Sodium	167 B	209 B	216 B	152 B	220 B	248 B	176 B	201 B
Thallium	1.7 B	2.5	1.4 B	0.41 U	0.43 U	0.43 U	1.6 B	0.74 B
Vanadium	4.6 B	9.2 B	2.2 B	1.5 B	2.4 B	10.7	5.1 B	9.8 B
Zinc	715 J	9,240 J	5,800 J	25.8 J	393 J	731 J	172 J	31.2 J

U The analyte was not detected. (Qualified by laboratory software).
J The assigned value is an estimate because the quality control criteria were not met.
B The analyte was detected at a level below the contract required detection limit (CRDL) but above the method detection limit (MDL), therefore the associated value is an estimate. The presence of the compound is reliable.
BJ The value is estimated because the analyte was detected at a concentration below the CRDL and because the quality control criteria were not met.
R The data are rejected.
* Source has been remediated
1 Data Validation not located

TABLE 4
Cement Creek Solid Source Sample Results – Total Metals – CDPHE 1996 Sampling [1]
Concentrations in milligrams per kilogram (mg/kg)

Location	North Fork	Middle Fork	Prospect Gulch				
	OP-SO-1	OP-SO-2	PG-SO-1	PG-SO-2	PG-SO-4	PG-SO-5	PG-SO-7
Analyte	Upper Gold King Mine Waste Rock Pile	Silver Ledge Mine Waste Rock Pile	Galena Queen Mine Waste Rock Pile *	Hercules Mine Waste Pile *	Henrietta (7) Mine Waste Pile *	Lark Mine Waste Rock Pile *	Joe & John's Mine Waste Rock Pile *
Aluminum	1,690	4,300	1,280	524	1,360	430	1,050
Antimony	15.6	0.62 U	26.8	32	40.5	45.6	41.9
Arsenic	25 J	4.3 J	106 J	154 J	130 J	62.2 J	324 J
Barium	72.3	8.3 B	159	48	260	308	413
Beryllium	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U
Cadmium	1.4	0.21 U	27.7	112	6.1	8.7	5.3
Calcium (D)	446 B	219 B	139 B	81.9 B	546 V	71.8 B	99.5 B
Chromium	1.4 B	2.7	0.44 B	0.38 B	0.21 U	5.4	1.7 B
Cobalt	0.71 B	0.79 B	0.21 U	0.21 U	1.6 B	0.47 B	0.48 B
Copper	252	5.3	220	335	295	99.9	447
Iron	18,400	6,310	6,670	15,400	23,500	3,680	18,900
Lead	3,380	172	17,300	74,000	16,000	2,560	7,310
Magnesium	1,060	6,010	29.8 B	18.1 B	224 B	8.3 B	81.2 B
Manganese	322 J	244 J	10.5 J	22.6 J	42.4 J	0.87 BJ	5.1 J
Mercury	0.47 J	0.2 J	0.67 J	1.6 J	0.3 J	0.81 J	1 J
Nickel	0.21 U	0.9 B	0.21 U	0.21 U	0.29 B	0.56 B	0.21 U
Potassium	1,070	431 B	734 B	799 B	1,560	435 B	1,210
Selenium	3.1	0.98 B	5.4	9.1	6.4	3.4	12.7
Silver	24.8	2.1	39.1	61.7	76.5	18.1	64.8
Sodium	363 B	185 B	170 B	164 B	209 B	154 B	194 B
Thallium	1.7 B	0.91 B	0.85 B	0.95 B	0.98 B	0.43 U	1.1 B
Vanadium	10.6	11.5	2.6 B	2.9 B	5.7 B	1.8 B	9 B
Zinc	366 J	33.8 J	7,560 J	22,300 J	1,550 J	2,070 J	1,580 J

U The analyte was not detected. (Qualified by laboratory software).
J The assigned value is an estimate because the quality control criteria were not met.
R The data are rejected.
B The analyte was detected at a level below the contract required detection limit (CRDL) but above the method detection limit (MDL), therefore the associated value is an estimate. The presence of the compound is reliable.
BJ The value is estimated because the analyte was detected at a concentration below the CRDL and because the quality control criteria were not met.
* Source has been remediated
1 Data Validation not located

TABLE 5
Cement Creek Surface Water and Sediment Samples – Total Metals Plus Cyanide Results– CDPHE 1996 Sampling [1]
Concentrations in micrograms per liter (µg/L) (Surface Water) – milligrams per kilogram (mg/kg) (Sediment)
(1 of 6)

	Upper Cement Creek															
Location	CC-SW-1 (µg/L)	CC-SE-1 (mg/kg)	CC-SW-2 (µg/L)	CC-SE-2 (mg/kg)	CC-SW-3 (µg/L)	CC-SE-3 (mg/kg)	CC-SW-4 (µg/L)	CC-SE-4 (mg/kg)	CC-SW-5 (µg/L)	CC-SE-5 (mg/kg)	CC-SW-6 (µg/L)	CC-SE-6 (mg/kg)	CC-SW-7 (µg/L)	CC-SE-7 (mg/kg)	CC-SW-8 (µg/L)	CC-SE-8 (mg/kg)
Analyte	BACKGROUND Cement Creek above Queen Anne		Cement Creek below Queen Anne		BACKGROUND Ross Basin Trib above Unnamed Mine		Ross Basin Trib below Unnamed Mine		Cement Creek above Mogul and S. Mogul Mines		Cement Creek below Mogul & S. Mogul Mines		Cement Creek above Corkscrew G. above Ferricrete		Cement Creek below Corkscrew G. below Ferricrete	
Flow (cfs)	0.08	NA	0.11	NA	0.63	NA	0.52	NA	1.42	NA	1.84	NA	1.42	NA	1.45	NA
pH	7.05	NA	5.46	NA	4.47	NA	4.47	NA	4.73	NA	3.83	NA	4.24	NA	5.01	NA
Conductivity	189	NA	394	NA	187	NA	182	NA	210	NA	225	NA	250	NA	359	NA
Hardness	83.3	NA	162	NA	83.3	NA	74.7	NA	86.6	NA	85.2	NA	102	NA	112	NA
Aluminum	40	6,420	3,224	12,400	284	18,000	840	13,800	818	13,300	1,241	12,100	1,114	13,900	1,108	11,100
Antimony	BD	0.76 U	BD	0.94 B	BD	0.67 U	BD	1.1 B	BD	2 B	BD	1.8 B	BD	0.65 UJ	BD	1.3 BJ
Arsenic	BD	119 J	BD	37.3	BD	33.5 J	BD	54.1 J	BD	30.6 J	BD	31 J	BD	28.6	BD	25.6
Barium	28.2	75.7	31.5	84.5	26.9	80.3	28.4	51.2 B	29.4	44.6 B	29	45 B	27.5	54.6	26	56.1
Beryllium	BD	1.6	BD	1 B	BD	1.6	BD	0.69 B	BD	0.86 B	BD	0.61 B	BD	0.72 B	BD	0.45 B
Cadmium	1.2	6.7	11.5	1 B	3.3	12.4	9.4	3.5	7.9	3.8	11.1	3.1	12.2	1.4	10	0.77 B
Calcium	NA	1,690	NA	1,750	NA	2,230	NA	1,680	NA	1,490	NA	1,540	NA	1,990	NA	1,420
Chromium	BD	2.9	BD	8	BD	7.5	BD	7.4	BD	7	BD	4.7	BD	8.4	BD	5.8
Cobalt	BD	14.8	BD	14.1	BD	23.6	BD	20.2	BD	14.5	BD	13.3	BD	12	BD	8.6 B
Copper	6.2	158	116	137	74.6	1,190	223.5	446	166.4	432	244	200 J	215.1	250	192.6	161
Iron	16.7	28,800	104	35,200	27	39,600	118.7	62,400	77.1	30,300	100.7	33,200	113.3	43,800	50.9	40,100
Lead	BD	1,610	2.8	377	3.6	961	3.3	747	4.6	834	4.8	722 J	5.6	395	6.3	307
Magnesium	NA	2,530	NA	7,770	NA	10,200	NA	8,760	NA	8,300	NA	8,500 J	NA	8,710	NA	6,820
Manganese	1.8	3,770	4,402.9	3,530	120.4	7,970 J	521.4	4,260 J	690.4	3,810 J	884.4	2,500 J	832.3	2,220 J	792.3	1,570 J
Mercury	NA	0.13 U	NA	0.12 U	NA	0.11 U	NA	0.13 U	NA	0.12 U	NA	0.13 U	NA	0.11 U	NA	0.12 U
Nickel	BD	6.3 B	11.9	6 B	BD	12.3	BD	7.9 BJ	BD	6.3 B	BD	5.5 B	BD	5.1 BJ	BD	3.8 B
Potassium	NA	1,010 B	NA	1,120 B	NA	636 B	NA	867 B	NA	626 B	NA	879 B	NA	734 B	NA	632 B
Selenium	BD	1.3	BD	1.4	BD	2	BD	1.5	BD	1.7	BD	1.6	BD	1.6	BD	1.8
Silver	NA	0.87 B	NA	1.4 B	NA	0.97 B	NA	1.9 B	NA	1.5 B	NA	1.6 B	NA	1 B	NA	1.6 B
Sodium	NA	168 B	NA	190 B	NA	172 B	NA	170 BJ	NA	166 B	NA	214 B	NA	217 B	NA	212 B
Thallium	BD	12.4	BD	11.6	BD	23.1	BD	14.7	BD	12.1	BD	9.2	BD	8.6	BD	6.6
Vanadium	BD	6.4 B	BD	23.4	BD	33.4	BD	40.1	BD	23	BD	22	BD	28.6	BD	24.6
Zinc	215.2	795 J	2,260	274 J	517.3	1,880 J	2,136.2	672 J	2,007.3	475 J	2,614.5	749	2,397	340 J	2,372	308 J
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.7 U	0.13 U	NA	NA	NA	NA

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J — The assigned value is an estimate because the quality control criteria were not met.
B or BD — The analyte was detected at a level below the contract required detection limit (CRDL) but above the method detection limit (MDL), therefore the associated value is an estimate. The presence of the compound is reliable.
BJ — The value is estimated because the analyte was detected at a concentration below the CRDL and because the quality control criteria were not met.
NA — Indicates that the analyte was not sampled/analyzed for.
cfs — Cubic feet per second.
1 — Data validation not located

TABLE 5

Cement Creek Surface Water and Sediment Samples – Total Metals Plus Cyanide Results – CDPHE 1996 Sampling [1]
Concentrations in micrograms per liter (µg/L) (Surface Water) – milligrams per kilogram (mg/kg) (Sediment)

(2 of 6)

	Cement Creek				N. Fork of Cement Creek				Minnehaha Creek				Middle Fork of Cement Creek					
Location	CC-SW-9 (µg/L)	CC-SE-9 (mg/kg)	CC-SW-13 (µg/L)	CC-SE-13 (mg/kg)	CC-SW-10 (µg/L)	CC-SE-10 (mg/kg)	CC-SW-12 (µg/L)	CC-SE-12 (mg/kg)	CC-SW-15 (µg/L)	CC-SE-15 (mg/kg)	CC-SW-16 (µg/L)	CC-SE-16 (mg/kg)	CC-SE-17 (mg/kg)	CC-SE-18 (mg/kg)	CC-SW-19 (µg/L)	CC-SE-19 (mg/kg)	CC-SW-20 (µg/L)	CC-SE-20 (mg/kg)
Analyte	Cement Creek below Red & Bonita Mine		Cement Creek below Confluence with North Fork		BACKGROUND North Fork above Gold King Mine		North Fork below Gold King Mine		Minnehaha Creek below Lead-Carbonate Mill		Minnehaha Creek above Confluence with South Fork		BACKGROND Middle F. above Unnamed Waste	Middle Fork below Unnamed Waste Rock Pile	Middle Fork below Black Hawk Mine		Middle Fork above confluence with South Fork	
Flow (cfs)	1.79	NA	1.15	NA	NA	NA	0.2	NA	0.05	NA	0.16	NA	NA	NA	0.62	NA	0.44	NA
pH	4.32	NA	4.54	NA	NA	NA	2.68	NA	4.24	NA	6.46	NA	NA	NA	6.68	NA	6.87	NA
Conductivity	361	NA	376	NA	NA	NA	2,090	NA	190	NA	143	NA	NA	NA	646	NA	580	NA
Hardness	114	NA	117	NA	NA	NA	262	NA	57.8	NA	61.7	NA	NA	NA	330	NA	304	NA
Aluminum	1,524	4,140	1,849	7,890	1,050	13,300	62,206	9,660 J	3,185	3,570	46	13,800	20,200	8,950	212	15,900	291	12,000
Antimony	BD	0.76 UJ	BD	0.7 UJ	3	0.69 UJ	BD	0.92 B	BD	7.1 BJ	BD	0.72 UJ	0.66 UJ	0.65 UJ	BD	0.79 UJ	BD	0.69 UJ
Arsenic	BD	4.8	BD	22.4	3	4.8	5.2	65.6 J	BD	13.9	BD	10.6	51.6	8.8	BD	26.6	BD	14.6
Barium	26.3	19.5 B	25.8	72.6	66.3	63.8	2.5	65.2	25.2	49.4 B	12.9	54.9	90.1	49.6	13	35.7 B	13	38.7 B
Beryllium	BD	0.25 U	BD	0.3 B	1	0.65 B	5.8	0.37 B	BD	0.44 U	BD	0.54 B	1.2	0.57 B	BD	1.5	BD	1 B
Cadmium	11.1	0.27 B	13.5	0.38 B	1.5	0.24 B	112	0.6 B	11.6	7.1	0.5	2.7	2.9	0.89 B	1.5	4	1	4.1
Calcium	NA	435 B	NA	725 B	NA	3,990	NA	1,250	NA	536 B	NA	2,690	2,110	2,840	NA	2,670	NA	2,420
Chromium	BD	1.8 B	BD	3	1	5.1	18	5.6	BD	2.6 B	BD	6.9	8	3.3	BD	4.7	BD	8.3
Cobalt	BD	2.4 B	BD	6 B	12.4	10.6 B	116	7.3 B	BD	4.6 B	6.8	16.1	29.5	10.9	BD	19.7	BD	19.4
Copper	196.8	91.6	217.6	83.9	5.2	49.9	6,292	87 J	268.4	181	6.3	181	657	165	13.7	284	12.9	233
Iron	146.8	25,500	218.2	68,600	1,440	36,500	88,912	72,300	3,877	39,100	67	42,200	58,100	20,000	789.8	33,700	720.6	29,200
Lead	6.4	170	7.3	291	3.6	21.8	3.5	713 J	170.7	2,220	1.8	225	666	164	2.4	160	1.7	138
Magnesium	NA	1,990	NA	4,350	NA	7,120	NA	5,870 J	NA	824 B	NA	9,580	11,800	5,760	NA	9,860	NA	9,100
Manganese	812.6	559 J	861.9	1,160 J	2,180	663 J	11,208	624 J	728.3	329 J	3.3	1,420 J	3,660 J	1,400 J	808.1	3,510 J	399.5	2,640 J
Mercury	NA	0.43	NA	0.12 U	0.2	0.12 U	NA	0.12 U	NA	0.22 U	NA	0.12 U	0.11 U	0.11 U	NA	0.13 U	NA	0.11 U
Nickel	BD	0.97 B	BD	3.8 BJ	17.9	7.3 B	80.7	2.5 BJ	BD	0.5 B	BD	7.4 B	10.6	6 B	BD	10.8	BD	11.4
Potassium	NA	238 B	NA	615 B	NA	1,370	NA	1,140 B	NA	605 B	NA	838 B	1,380	730 B	NA	622 B	NA	479 B
Selenium	BD	1 U	BD	3.3	4	0.92 U	BD	3.8	BD	5.8 U	BD	1.7	2.6	0.9 B	BD	1 U	BD	1.7
Silver	NA	2.1 B	NA	0.84 B	1	0.23 U	NA	1.6 B	NA	15.3	NA	0.76 B	4	0.92 B	NA	1.1 B	NA	0.39 B
Sodium	NA	237 B	NA	224 B	NA	326 B	NA	316 B	NA	450 B	NA	285 B	238 B	181 B	NA	190 B	NA	177 B
Thallium	BD	2.6	BD	6.9	6.8	3.2	BD	5.2	BD	2.5 B	BD	5.6	13.1	4.8	BD	12.1	BD	9
Vanadium	BD	8 B	BD	26.4	1	26.4	BD	40.9	BD	8.1 B	BD	43.8	46.7	20.8	BD	30.5	BD	34.7
Zinc	2,618.8	133 J	2,700.3	147 J	212	106 J	21,932	174	2,557.5	1,810 J	93	789 J	569 J	217 J	368.7	1,090 J	236	990 J
Cyanide	NA	NA	NA	NA	NA	NA	5.4 U	0.12 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

U	The analyte was not detected. (Qualified by laboratory software).
J	The assigned value is an estimate because the quality control criteria were not met.
B or BD	The analyte was detected at a level below the contract required detection limit (CRDL) but above the method detection limit (MDL), therefore the associated value is an estimate. The presence of the compound is reliable.
BJ	The value is estimated because the analyte was detected at a concentration below the CRDL and because the quality control criteria were not met.
NA	Indicates that the analyte was not sampled/analyzed for.
cfs	Cubic feet per second.
1	Data Validation not located

TABLE 5
Cement Creek Surface Water and Sediment Samples – Total Metals Plus Cyanide Results – CDPHE 1996 Sampling [1]
Concentrations in micrograms per liter (µg/L) (Surface Water) – milligrams per kilogram (mg/kg) (Sediment)
(3 of 6)

	South Fork						Cement Creek								
Location	CC-SW-21 (µg/L)	CC-SE-21 (mg/kg)	CC-SW-22 (µg/L)	CC-SE-22 (mg/kg)	CC-SW-23 (µg/L)	CC-SE-23 (mg/kg)	CC-SE-13 (mg/kg)	CC-SW-33 (µg/L)	CC-SE-33 (mg/kg)	CC-SW-24 (µg/L)	CC-SE-24 (mg/kg)	CC-SW-25 (µg/L)	CC-SE-25 (mg/kg)	CC-SW-26 (µg/L)	CC-SE-26 (mg/kg)
Analyte	BACKGROUND South Fork above Silver Ledge Mine		South Fork below Silver Ledge Mine		South Fork above Confluence with Cement Creek		Cement Creek below Confluence with North Fork	Cement Creek above Confluence with South Fork		Cement Creek below Confluence with South Fork		Cement Creek below Confluence with Dry Gulch Adit		Cement Creek below Confluence with Prospect G.	
Flow (cfs)	0.38	NA	1.36	NA	2.27	NA	NA	2.88	NA	4.36	NA	6.5	NA	7.09	NA
pH	6.32	NA	5.71	NA	5.6	NA	NA	7.9	NA	6.11	NA	5.44	NA	4.79	NA
Conductivity	180	NA	658	NA	738	NA	NA	1,567	NA	1,227	NA	1,071	NA	1,119	NA
Hardness	82	NA	337	NA	294	NA	NA	694	NA	500	NA	444	NA	406	NA
Aluminum	492	5,890	2,153	5,990	1957	6,990	7,890	861	5,090	1,445	7,660 J	2,148	8,470	3,746	7,170
Antimony	BD	0.66 UJ	BD	0.68 UJ	BD	0.68 UJ	0.7 UJ	BD	0.67 U	BD	0.7 U	BD	0.97 BJ	BD	1.7 BJ
Arsenic	BD	9.1	BD	16.7	BD	8.5	22.4	BD	10.7 J	BD	15.8 J	BD	17.3	1.6	29.5
Barium	10.2	50.7	9.9	75.5	11.1	30 B	72.6	12.8	23.1 B	11.9	22.1 B	10.8	36.8 B	10	68.2
Beryllium	BD	0.51 B	BD	0.65 B	BD	0.51 B	0.3 B	BD	0.22 U	BD	0.28 B	BD	0.27 B	BD	0.28 B
Cadmium	BD	0.22 B	2.2	0.23 U	2.6	0.23 U	0.38 B	2.8	0.35 B	2.8	0.36 B	2.6	16.6	2.6	14.4
Calcium	NA	1,030 B	NA	1,400	NA	1,030 B	725 B	NA	1,680	NA	1,380	NA	1,840	NA	1,400
Chromium	BD	2.3	BD	3.4	BD	2.9	3	BD	2.3	BD	8.2	BD	4.6	4.3	3.4
Cobalt	BD	8.9 B	16	3.3 BJ	13.3	3.1 B	6 B	BD	4.1 B	5.8	6.1 B	7.7	4 B	14.3	6.1 B
Copper	6.5	37	27.1	48.9	29.9	48.8	83.9	23.9	42.9 J	25.2	59.3 J	19.7	477	28.9	105
Iron	120.9	31,100	6,637.3	46,200	3,216.9	30,800	68,600	531.6	21,300	2,021.4	44,700	4,023.5	41,600	8,559.9	58,800
Lead	BD	36	2.5	69.4	2.3	55.6	291	11.9	153 J	8.4	142 J	14.5	1,040	13.3	505
Magnesium	NA	3,020	NA	2,750	NA	4,470	4,350	NA	3,120	NA	5,150 J	NA	5,400	NA	4,450
Manganese	59	478 J	1,276.1	342 J	1,659.7	599 J	1,160 J	2,050.8	547 J	1,671.6	563 J	1,646.9	701 J	1,458.9	1,420 J
Mercury	NA	0.11 U	NA	0.11 U	NA	0.11 U	0.12 U	NA	0.11 U	NA	0.12 U	NA	0.12 U	NA	0.12 U
Nickel	BD	3.2 B	BD	0.84 BJ	BD	0.95 B	3.8 BJ	BD	2.1 B	BD	2.5 BJ	BD	2.6 B	BD	1.7 BJ
Potassium	NA	887 B	NA	1,280	NA	652 B	615 B	NA	484 B	NA	476 B	NA	747 B	NA	863 B
Selenium	BD	1.7	BD	2.8	BD	1.6	3.3	BD	0.89 UJ	BD	2.4	BD	2.1	BD	2.8
Silver	NA	0.23 B	NA	0.35 B	NA	0.23 U	0.84 B	NA	0.5 B	NA	0.75 B	NA	8.5	NA	1.8 B
Sodium	NA	230 B	NA	379 B	NA	181 B	224 B	NA	154 B	NA	191 B	NA	235 B	NA	210 B
Thallium	BD	2.7	BD	2.9 J	BD	3.1	6.9	BD	2.1 B	BD	3.7	BD	3.7	BD	6.8
Vanadium	BD	18.7	3	20.9	BD	18.8	26.4	BD	12.3	BD	24.4	BD	35.4	BD	26.6
Zinc	41	79.2 J	451.8	55.6 J	707.1	78.6 J	147 J	724.9	70.3	659.1	146	706.3	4,460 J	678.7	2,940 J
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.2 U	0.12 U	NA	NA	NA	NA

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NA — Indicates that the analyte was not sampled/analyzed for.
cfs — Cubic feet per second.
1 — Data Validation not located

TABLE 5
Cement Creek Surface Water and Sediment Samples – Total Metals Plus Cyanide Results – CDPHE 1996 Sampling [1]
Concentrations in micrograms per liter (µg/L) (Surface Water) – milligrams per kilogram (mg/kg) (Sediment)
(4 of 6)

Location	CC-SE-27 (mg/kg)	CC-SW-28 (µg/L)	CC-SE-28 (mg/kg)	CC-SW-29 (µg/L)	CC-SE-29 (mg/kg)	CC-SW-30 (µg/L)	CC-SE-30 (mg/kg)	CC-SW-31 (µg/L)	CC-SE-31 (mg/kg)	CC-SW-48 (µg/L)	CC-SE-CC-48 (mg/kg)
Analyte	Georgia Gulch above Confluence with Cement Cr	Cement Creek below Confluence with Georgia G.		Cement Creek above Confluence with Porcupine G.		Porcupine Gulch above Confluence with Cement Creek		Cement Creek below Confluence with Porcupine G.		Cement Creek above Confluence with Animas River	
Flow (cfs)	NA	9.49	NA	13.72	NA	0.14	NA	11.89	NA	17.64	NA
pH	NA	3.86	NA	3.71	NA	4.45	NA	3.76	NA	4.1	NA
Conductivity	NA	772	NA	805	NA	197.00	NA	820	NA	790	NA
Hardness	NA	450	NA	452	NA	90.10	NA	442	NA	439	NA
Aluminum	10,200	6,319	7,340	5,882	11,600	2,114.00	5,030.00	5,538	8,010 J	5,183	7,820
Antimony	0.63 UJ	BD	2.6 U	BD	1.7 U	BD	1.6 U	BD	1.3 U	BD	2 U
Arsenic	29.6	7.5	49 J	4.5	27.3 J	BD	40.6 J	4.6	27.6	2.1	38.1 J
Barium	104	9.8	51	10.6	48.7 B	27	81	9.9	38.8 B	12.4	131
Beryllium	0.76 B	BD	0.32 B	BD	0.4 B	BD	0.42 B	BD	0.27 B	BD	0.33 B
Cadmium	1.7	2.3	5.1	2.5	0.86 BJ	2.5	3.6	2.1	1 BJ	2.1	1.7 J
Calcium	1,540	NA	1,290	NA	1,810	NA	1,310	NA	1,270	NA	1,350
Chromium	3.5	BD	4.7	BD	5.4	BD	0.079 B	BD	7.2	BD	6.1
Cobalt	12.2	17.3	4.6 BJ	17.2	11.4 B	9.9	10.8 B	11.8	5 B	13.1	6.5 B
Copper	189	14.4	79 J	24.4	90 J	46.8	60.2 J	26	94.5 J	26.3	58.4 J
Iron	30,300	18,827	62,900	13,694	49,500	457.8	27,600	12,569	45,600	7,992.6	63,400
Lead	475	14.7	384 J	17.1	590 J	4.6	1,040 J	15.7	196 J	12.4	297 J
Magnesium	6,010	NA	4,580	NA	7,850	NA	2,980	NA	5,720 J	NA	4,520
Manganese	1,910 J	1,732.6	488 J	1,756.2	1,370 J	869.9	1,920 J	1,537.5	470 J	1,558.9	605 J
Mercury	0.11 U	NA	0.12 U	NA	0.13 U	NA	0.13 U	NA	0.11 U	NA	0.12 U
Nickel	6.6 B	13.4	1.8 B	BD	4.4 BJ	BD	0.74 B	BD	2.9 BJ	BD	2.2 BJ
Potassium	806 B	NA	938 B	NA	761 B	NA	665 B	NA	621 B	NA	1,090 B
Selenium	1.6	BD	3.3 J	BD	1.9 J	BD	1.7 J	BD	2.2	BD	2.6 J
Silver	0.9 B	NA	1.1 B	NA	0.89 B	NA	2.8	NA	1.9 B	NA	1.2 B
Sodium	210 B	NA	221 B	NA	272 B	NA	188 B	NA	194 B	NA	244 B
Thallium	7	BD	3.7	BD	5.4	BD	6.6	BD	2.9	BD	3.9
Vanadium	19.4	BD	33	5.1	27.6	BD	20.12	BD	29.7	BD	30.9
Zinc	395 J	863.5	1,110	881.6	136	590.1	904	764.8	222	677.4	369
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	0.11 U	NA	NA

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NA	Indicates that the analyte was not sampled/analyzed for.
cfs	Cubic feet per second.
1	Data Validation not located

TABLE 5

Cement Creek Surface Water and Sediment Samples – Total Metals Plus Cyanide Results – CDPHE 1996 Sampling [1]
Concentrations in micrograms per liter (µg/L) (Surface Water) – milligrams per kilogram (mg/kg) (Sediment)
(5 of 6)

Location	Prospect Gulch																			
	PG-SW-1 (µg/L)	PG-SE-1 (mg/kg)	PG-SW-2 (µg/L)	PG-SE-2 (mg/kg)	PG-SW-3 (µg/L)	PG-SE-3 (mg/kg)	PG-SW-4 (µg/L)	PG-SE-4 (mg/kg)	PG-SW-5 (µg/L)	PS-SE-5 (mg/kg)	PG-SW-6 (µg/L)	PG-SE-6 (mg/kg)	PG-SW-7 (µg/L)	PG-SE-7 (mg/kg)	PG-SW-8 (µg/L)	PG-SE-8 (mg/kg)	PG-SW-9 (µg/L)	PG-SE-9 (mg/kg)	PG-SW-10 (µg/L)	PG-SE-10 (mg/kg)
Analyte	Prospect Gulch above the Galena Queen Mine		Prospect Gulch above the Galena Queen Mine		Prospect Gulch below the Galena Queen Mine		Tributary to Prospect Gulch		Tributary with Acid Drainage		Tributary with Hercules Mine Waste		Tributary with Acid Drainage		Prospect Gulch below Tributaries with Acid Drainage		Prospect G. below Mineralized Canyon above Henrietta Mine		Mineralized Trib above Henrietta Mine Complex	
Flow (cfs)	0	NA	0.01	NA	0	NA	0.00	NA	0.01	NA	0	NA	0	NA	0.02	NA	0.05	NA	0.01	NA
pH	4.48	NA	4.46	NA	2.73	NA	5.46	NA	6	NA	3.62	NA	3.67	NA	3.95	NA	3.61	NA	3.66	NA
Conductivity	112	NA	194	NA	1,073	NA	585	NA	490	NA	256	NA	575	NA	772.00	NA	414	NA	363	NA
Hardness	37.3	NA	72.1	NA	49	NA	256	NA	199	NA	44.8	NA	201	NA	138.00	NA	135	NA	90.3	NA
Aluminum	40	7,040	638	3,630	6,955	2,030	482	16,400 J	93	15,900	1,861	4,340	3,379	10,100	1,279.00	5,390.00	1,920	3,080	8,028	2,390
Antimony	BD	0.85 U	BD	1.7 U	BD	48.8	BD	0.8 U	BD	0.74 U	BD	9.3 B	BD	5.2 B	BD	2.9 U	BD	2.7 U	BD	2.8 U
Arsenic	BD	52.3 J	BD	59.6 J	2.3	600 J	BD	14.8 J	BD	14.3 J	BD	68.9 J	BD	137 J	BD	99.3 J	BD	84.9 J	BD	42.3 J
Barium	62.3	83.7	42.9	84	35.6	62.8	44.4	85.2	43.7	78.9	56.8	52.5	36.2	32 B	42.3	69.8	45.9	22.9 B	52.9	62.5
Beryllium	BD	0.43 B	BD	0.39 B	BD	0.25 U	BD	1.4	BD	1.2 B	BD	0.24 U	BD	0.59 B	BD	0.37 B	BD	0.24 U	BD	0.26 U
Cadmium	BD	0.53 B	BD	0.65 BJ	111	29.2	1.5	3.1	0.5	2.5	4.3	0.34 B	1.5	0.44 B	7.8	1.6	7.9	1.2	BD	0.26 U
Calcium	NA	1,780	NA	1,090 B	NA	141 B	NA	3,880	NA	3,760	NA	235 B	NA	1,730	NA	837 B	NA	831 B	NA	218 B
Chromium	BD	3	BD	1.9 B	BD	3.7	BD	2.9	BD	2.6	BD	3	BD	5.5 B	BD	2.8	BD	2.3 B	BD	2.3 B
Cobalt	6.5	13.3 B	5.9	6.2 BJ	23.3	1.3 B	7.6	26.3	BD	18.2	11.9	0.93 B	17.7	9.8 J	9.6	6.1 B	10.5	3.3 B	27.4	0.64 B
Copper	25.5	74.2 J	BD	48.8 J	3,116.6	1,080 J	55.2	62.5 J	BD	57.6 J	140.1	40.6 J	130.6	112	186	98.4 J	171.2	169 J	22.8	12.9 J
Iron	18.7	41,800	1,034.1	79,100	18,050	33,900	324.1	34,300	369.4	39,700	1,056.1	42,100	802.1	38,700 J	552.6	45,500	919.8	18,800	235	21,300
Lead	BD	68 J	2.5	260 J	1,027.4	7,230 J	BD	50.4 J	BD	40.8 J	155.9	121 J	17	325	72.77	326 J	62.6	199 J	41.2	191 J
Magnesium	NA	3,280	NA	756 B	NA	456 B	NA	5,390 J	NA	6,500	NA	1,460	NA	4,750 J	NA	1,570	NA	1,320	NA	613 B
Manganese	28.9	779 J	172.3	375 J	494.7	98.5 J	149.4	3,420 J	67.6	1,400 J	244.9	73.2 J	939.1	394 U	322.5	467 J	345.7	147 J	1,035.6	87.6 J
Mercury	NA	0.14 U	NA	0.13 U	NA	0.34	NA	0.13 U	NA	0.12 U	NA	0.12 U	NA	0.12 U	NA	0.13 U	NA	0.12 U	NA	0.13 U
Nickel	BD	4.8 B	BD	0.37 B	12.4	0.25 U	BD	12.4	13.4	12.3	BD	0.24 U	BD	5.4 B	BD	1.5 B	BD	1.3 B	20.4	0.26 U
Potassium	NA	1,070 B	NA	838 B	NA	770 B	NA	1340	NA	1,240	NA	844 B	NA	1,080 B	NA	899 B	NA	414 B	NA	1,190 B
Selenium	BD	2.1 J	BD	3.9 J	BD	3.7 J	BD	1.1 U	BD	1 BJ	BD	2.9 J	BD	2.2 J	BD	3.1 J	BD	1.7 J	BD	4.3 J
Silver	NA	0.28 U	NA	0.49 B	NA	10.6	NA	0.27 U	NA	0.25 U	NA	0.24 U	NA	3.3	NA	1.3 B	NA	1.6 B	NA	0.92 B
Sodium	NA	204 B	NA	205 B	NA	18,201.9 B	NA	269 B	NA	210 B	NA	164 B	NA	160 B	NA	175 B	NA	129 B	NA	153 B
Thallium	BD	3.5	BD	4.4	BD	6,780 B	BD	11.2	BD	5.3	BD	1.9 B	BD	2.4 B	BD	3.2	BD	0.85 B	BD	0.88 B
Vanadium	BD	19.2	BD	21.1	BD	9.1 B	3.3	23.5	BD	24.2	BD	16.6	BD	22.3	BD	16	BD	7.2 B	BD	9.8 B
Zinc	21.8	90.3	44.9	43.6	28,243	8,254	985.1	734	191.2	634	797.2	20.3	231.3	98.1	1,720.8	340	1,750.9	386	171.4	15.6
Cyanide	NA	NA	NA	NA	2 U	NA	NA	0.14 BJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

U	The analyte was not detected. (Qualified by laboratory software).
J	The assigned value is an estimate because the quality control criteria were not met.
B or BD	The analyte was detected at a level below the contract required detection limit (CRDL) but above the method detection limit (MDL), therefore the associated value is an estimate. The presence of the compound is reliable.
BJ	The value is estimated because the analyte was detected at a concentration below the CRDL and because the quality control criteria were not met.
NA	Indicates that the analyte was not sampled/analyzed for.
cfs	Cubic feet per second.
1	Data Validation not located

TABLE 5
Cement Creek Surface Water and Sediment Samples – Total Metals Plus Cyanide Results – CDPHE 1996 Sampling [1]
Concentrations in micrograms per liter (µg/L) (Surface Water) – milligrams per kilogram (mg/kg) (Sediment)
(6 of 6)

	Prospect Gulch									Upper Animas Gauging Stations							
Location	PG-SW-11 (µg/L)	PG-SE-11 (mg/kg)	PG-SE-14 (mg/kg)	PG-SE-15 (mg/kg)	PG-SW-16 (µg/L)	PG-SE-16 (mg/kg)	PG-SW-18 (µg/L)	PG-SE-18 (mg/kg)	PG-SE-19 (mg/kg)	CC-SW-CC48 (µg/L)	CCSECC48 (mg/kg)	CCM34 (µg/L)	CCSEM34 (mg/kg)	CCA68 (µg/L)	CCSEA68 (mg/kg)	CCA72 (µg/L)	CCSEA72 (mg/kg)
Analyte	Prospect Gulch below Mineralized Tributaries		Springs after seeping through Henrietta Waste	Prospect Gulch below Henrietta Waste Pile	Prospect Gulch below the Henrietta Mine Seep		Prospect Gulch below Joe & John's Mine		Prospect Gulch above Confluence with Cement Creek	Cement Creek above Confluence with Animas River		Mineral Creek above Confluence with Animas R.		Animas River above Cement Creek		Animas River below Confluence with Mineral Creek	
Flow (cfs)	0.05	NA	NA	NA	0.05	NA	0.04	NA	NA	17.64	NA	51	NA	55	NA	127	NA
pH	3.33	NA	NA	NA	3.08	NA	2.82	NA	NA	4.1	NA	7.7	NA	8.35	NA	7.97	NA
Conductivity	351	NA	NA	NA	741	NA	694	NA	NA	790	NA	313	NA	273	NA	377	NA
Hardness	125	NA	NA	NA	130	NA	122	NA	NA	439	NA	168	NA	125	NA	186	NA
Aluminum	2,731	4,350	4,230	4,790	6,289	3,770 J	6,034	4,440	3,950	5,183	7,820	2,222	11,500	69	7,820	1,530	10,700
Antimony	BD	1.8 J	4.7 J	3.3 UJ	BD	3.3 U	BD	5.3 B	4.9 B	BD	2 U	BD	0.86 BU	BD	2.6 BU	BD	401 BU
Arsenic	BD	65.1 J	389	48.2	1.9	98.1 J	BD	76.9 J	101 J	2.1	38.1 J	BD	29.9 J	BD	17.3 J	2.1	33.5 J
Barium	40.8	41.8 B	201	93.2	29.8	99.8	27.9	72.5	73.4	12.4	131	24.2	121	24.9	107	22.3	151
Beryllium	BD	0.26 U	0.26 U	0.26 U	BD	0.26 U	BD	0.23 U	0.24 U	BD	0.33 B	BD	0.7 B	BD	0.87 B	BD	0.93 B
Cadmium	6.3	0.61 B	2.3	5.7	12.5	331 B	12.8	0.37 B	0.84 B	2.1	1.7 J	1.1	1.7	1.5	10.1	1.5	3.6
Calcium	NA	1,100 B	235	715	NA	711 B	NA	409 B	397 B	NA	1,350	NA	2,450	NA	2,490	NA	2,970
Chromium	BD	1.3 B	2.7	2.3	BD	1.8 B	BD	2.4	2.1 B	BD	6.1	BD	3.3	BD	5.1	BD	7
Cobalt	8.6	6 B	1.4 J	4.2	25.9	3.1 B	25.2	4.2 BJ	1.7 BJ	13.1	6.5 B	7.6	17.1	BD	11 B	BD	15.5
Copper	162.7	59.8 J	73.6	41.1	676.9	63.9 J	616.8	57.3 J	62.7 J	26.3	58.4 J	33.6	161 J	BD	263 J	18.2	242 J
Iron	270	36,200	93,800	34,400	15,458	40,000	9,842	44,400	68,900	7,992.6	63,400	3,244.2	40,500	98.5	21,200	2,235.8	46,100
Lead	63	216 J	503	536	124.61	333 J	103.25	336 J	340 J	12.4	297 J	5.8	189 J	1.4	1,580 J	4.3	805 J
Magnesium	NA	1,850	1,360	1,880	NA	1,460 J	NA	1,430	1,710	NA	4,520	NA	3,780	NA	4710	NA	5,200
Manganese	421.8	284 J	114 J	316 J	772.5	206 J	751.3	289 J	210 J	1,558.9	605 J	298.7	928 J	672.3	7,410 J	618.6	3,300 J
Mercury	NA	0.13 U	0.17 U	0.13 U	NA	0.13 U	NA	0.13 U	0.12 U	NA	0.12 U	NA	0.12 U	NA	0.13 U	NA	0.13 U
Nickel	BD	0.87 B	0.26 U	2.2	16.3	0.47 B	13.9	0.76 BJ	0.24 U	BD	2.2 BJ	BD	4.8 B	BD	5.2 B	BD	5 B
Potassium	NA	774 B	1,650	875	NA	752 B	NA	950 B	873 B	NA	1,090 B	NA	799 B	NA	1,240 B	NA	1,110 B
Selenium	BD	2.7 J	3.2 J	1.8	BD	3.9	BD	2.6 J	1.7 J	BD	2.6 J	BD	1.8 J	BD	1 UJ	BD	1.8 J
Silver	NA	6.2	2.7	3.7	NA	1.4 B	NA	1.3 B	1.7 B	NA	1.2 B	NA	0.41 B	NA	6.7	NA	2.3 B
Sodium	NA	160 B	247	234	NA	197 B	NA	189 B	188 B	NA	244 B	NA	216 B	NA	239 B	NA	223 B
Thallium	BD	1.9 B	4.9 J	2.8	BD	2.6	BD	3.1 J	4.1 J	BD	3.9	BD	4	BD	22.5	BD	11.1
Vanadium	BD	12.9 B	30.8	13.7	BD	15.1	BD	14.6	33.7	BD	30.9	BD	20.3	BD	19.9	BD	28.3
Zinc	1,615.4	79.6	450 J	1,190 J	2,913.3	56.7	3,020.6	79.6	256	677.4	369	286.6	528	431.8	1,830	416.1	901
Cyanide	NA	NA	NA	NA	2 U	0.13 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

U The analyte was not detected. (Qualified by laboratory software).
J The assigned value is an estimate because the quality control criteria were not met.
B or BD The analyte was detected at a level below the contract required detection limit (CRDL) but above the method detection limit (MDL), therefore the associated value is an estimate. The presence of the compound is reliable.
BJ The value is estimated because the analyte was detected at a concentration below the CRDL and because the quality control criteria were not met.
NA Indicates that the analyte was not sampled/analyzed for.
cfs Cubic feet per second.
1 Data Validation not located

APPENDIX A

Photolog

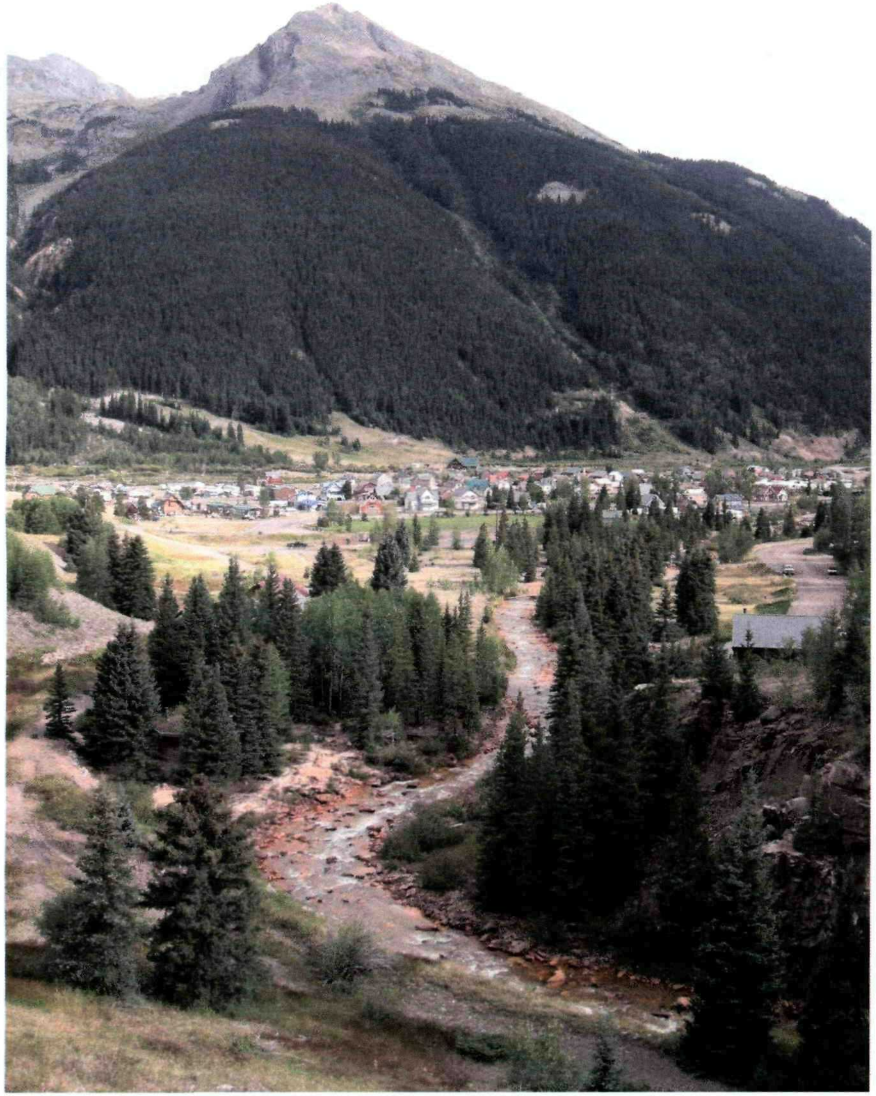

PHOTO 1
View to the south of Cement Creek flowing through the town of Silverton, Colorado. Note staining of stream rocks in stream bed.

PHOTO 2
Streamside wetlands along upper Cement Creek below Minnesota Gulch.

APPENDIX B

Wildlife Species in San Juan County

San Juan county

Status List

Back to Planning page...

Status	Common Name	Scientific Name	Occurence	Abundance
CDOW Big Game	American Elk	Cervus elaphus	Known to occur	Abundant
CDOW Big Game	Bighorn Sheep	Ovis canadensis	Known to occur	Fairly Common
CDOW Big Game	Black Bear	Ursus americanus	Known to occur	Common
CDOW Big Game	Moose	Alces alces	Known to occur	Uncommon
CDOW Big Game	Mountain Goat	Oreamnos americanus	Known to occur	Fairly Common
CDOW Big Game	Mountain Lion	Felis concolor	Known to occur	Uncommon
CDOW Big Game	Mule Deer	Odocoileus hemionus	Known to occur	Abundant
CDOW Furbearer	American Badger	Taxidea taxus	Known to occur	Uncommon
CDOW Furbearer	American Beaver	Castor canadensis	Known to occur	Fairly Common
CDOW Furbearer	Bobcat	Lynx rufus	Known to occur	Uncommon
CDOW Furbearer	Common Muskrat	Ondatra zibethicus	Known to occur	Common
CDOW Furbearer	Coyote	Canis latrans	Known to occur	Fairly Common
CDOW Furbearer	Raccoon	Procyon lotor	Likely to occur	Unknown
CDOW Furbearer	Red Fox	Vulpes vulpes	Known to occur	Uncommon
CDOW Furbearer	Striped Skunk	Mephitis mephitis	Known to occur	Fairly Common
CDOW Other Game	European Starling	Sturnus vulgaris	Known to occur	Uncommon
CDOW Other Game	House Sparrow	Passer domesticus	Known to occur	Uncommon
CDOW Small Game Bird	American Crow	Corvus brachyrhynchos	Known to occur	Uncommon
CDOW Small Game Bird	Band-tailed Pigeon	Columba fasciata	Known to occur	Unknown
CDOW Small Game Bird	Blue Grouse	Dendragapus obscurus	Known to occur	Uncommon
CDOW Small Game Bird	Common Snipe	Gallinago gallinago	Known to occur	Unknown
CDOW Small Game Bird	Green-winged Teal	Anas crecca	Known to occur	Uncommon
CDOW Small Game Bird	Mourning Dove	Zenaida macroura	Known to occur	Uncommon
CDOW Small Game Bird	Sora	Porzana carolina	Known to occur	Unknown
CDOW Small Game Bird	White-tailed Ptarmigan	Lagopus leucurus	Known to occur	Uncommon
CDOW Small Game Mammal	Mountain Cottontail	Sylvilagus nuttallii	Known to occur	Fairly Common
CDOW Small Game Mammal	Pine Squirrel	Tamiasciurus hudsonicus	Known to occur	Fairly Common
CDOW Small Game Mammal	Snowshoe Hare	Lepus americanus	Known to occur	Fairly Common
CDOW Small Game Mammal	White-tailed Jackrabbit	Lepus townsendii	Known to occur	Fairly Common
CDOW Small Game Mammal	Yellow-bellied Marmot	Marmota flaviventris	Known to occur	Common
Federal Candidate Species	Boreal Toad	Bufo boreas	Likely to occur	Unknown
Federally Endangered	Southwestern Willow Flycatcher	Empidonax traillii extimus	Known to occur	Uncommon
Federally Threatened	Lynx	Lynx canadensis	Known to occur	Very Rare
State Endangered	Boreal Toad	Bufo boreas	Likely to occur	Unknown
State Endangered	Lynx	Lynx canadensis	Known to occur	Very Rare
State Endangered	Southwestern Willow Flycatcher	Empidonax traillii extimus	Known to occur	Uncommon
State Endangered	Wolverine	Gulo gulo	Known to occur	Extirpated
State Special Concern	Northern Leopard Frog	Rana pipiens	Known to occur	Unknown
State Special Concern	Northern Pocket Gopher	Thomomys talpoides	Known to occur	Common